$\Lambda_b^0 \to \Lambda_c^+ \pi^-$ Lifetime Measurement

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Talk Outline

- Fits in σ_{ct} slices
- Final Version of the Fit

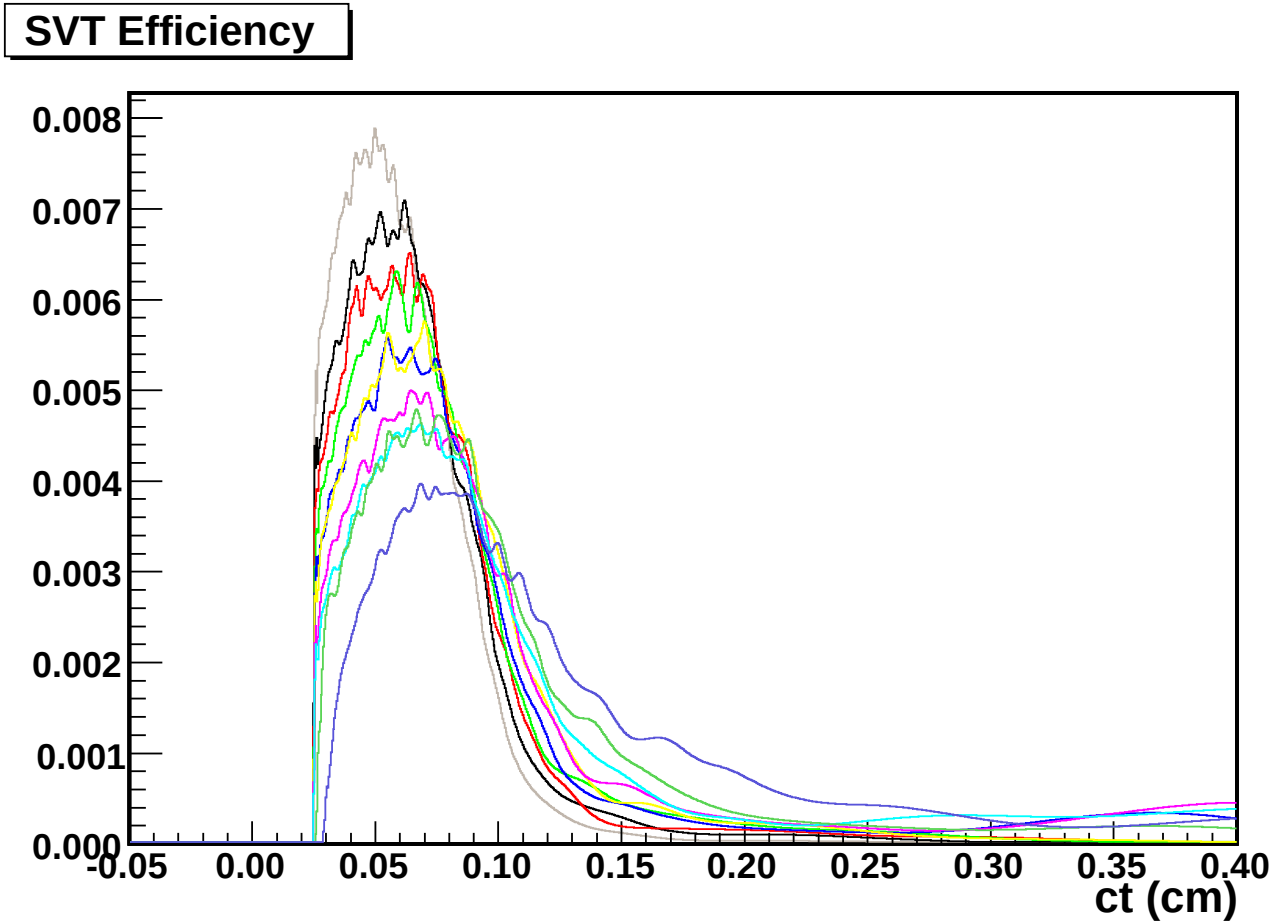
σ_{ct} Slices

Cut our $\sim 330,000$ event Signal MC sample into 10 slices.

slice	σ_{ct} range [cm]			nevents
0	1e-7	-	0.001435	33,180
1	0.001435	-	0.001635	33,256
2	0.001635	-	0.001793	33,164
3	0.001793	-	0.001936	33,153
4	0.001936	-	0.002076	33,237
5	0.002076	-	0.002220	33,241
6	0.002220	-	0.002378	33,144
7	0.002378	-	0.002569	33,183
8	0.002569	-	0.002858	33,015
9	0.002858	-	0.012	32,536

Efficiency in σ_{ct} Slices

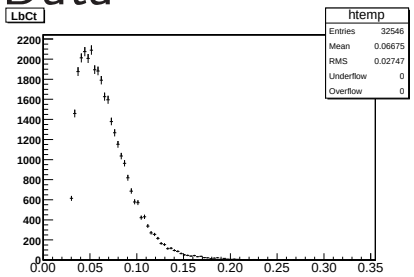
An efficiency distribution is calculated for each slice in σ_{ct}.



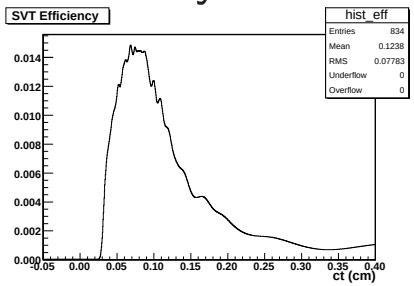
Fits in σ_{ct} Slices I

As a cross-check, we fit each σ_{ct} slice separately.
For Example, Slice 9 ($\sigma_{ct} \in [0.002858, 0.012]$)

Data

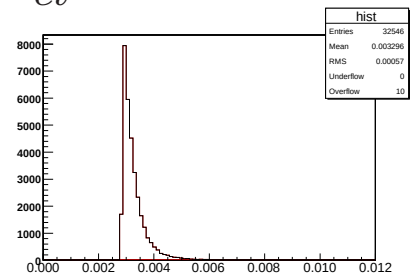


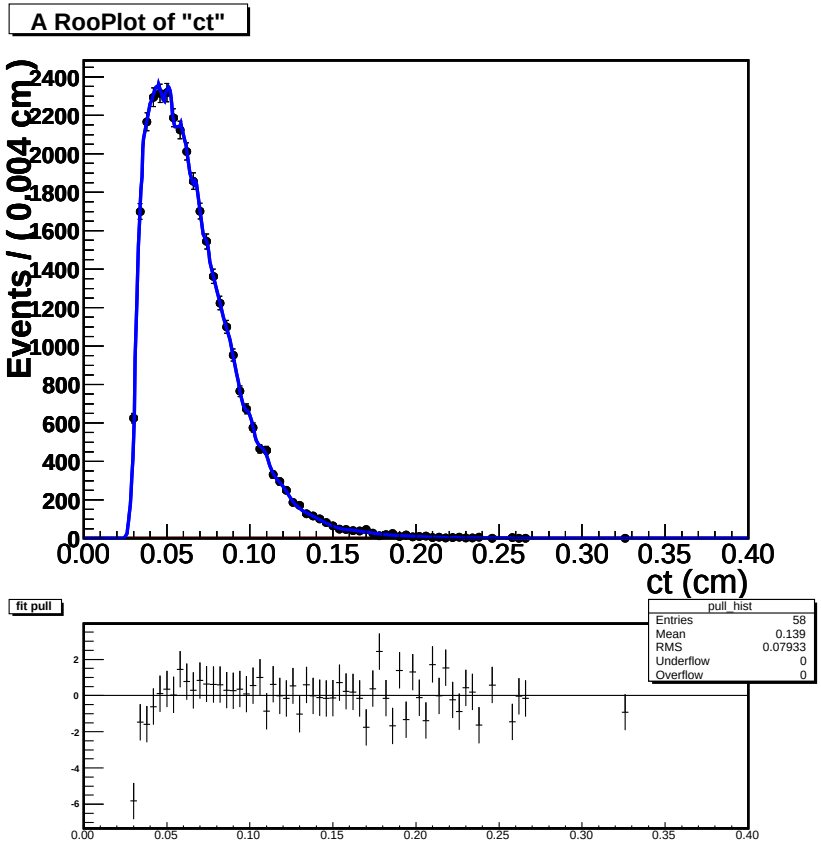
Efficiency



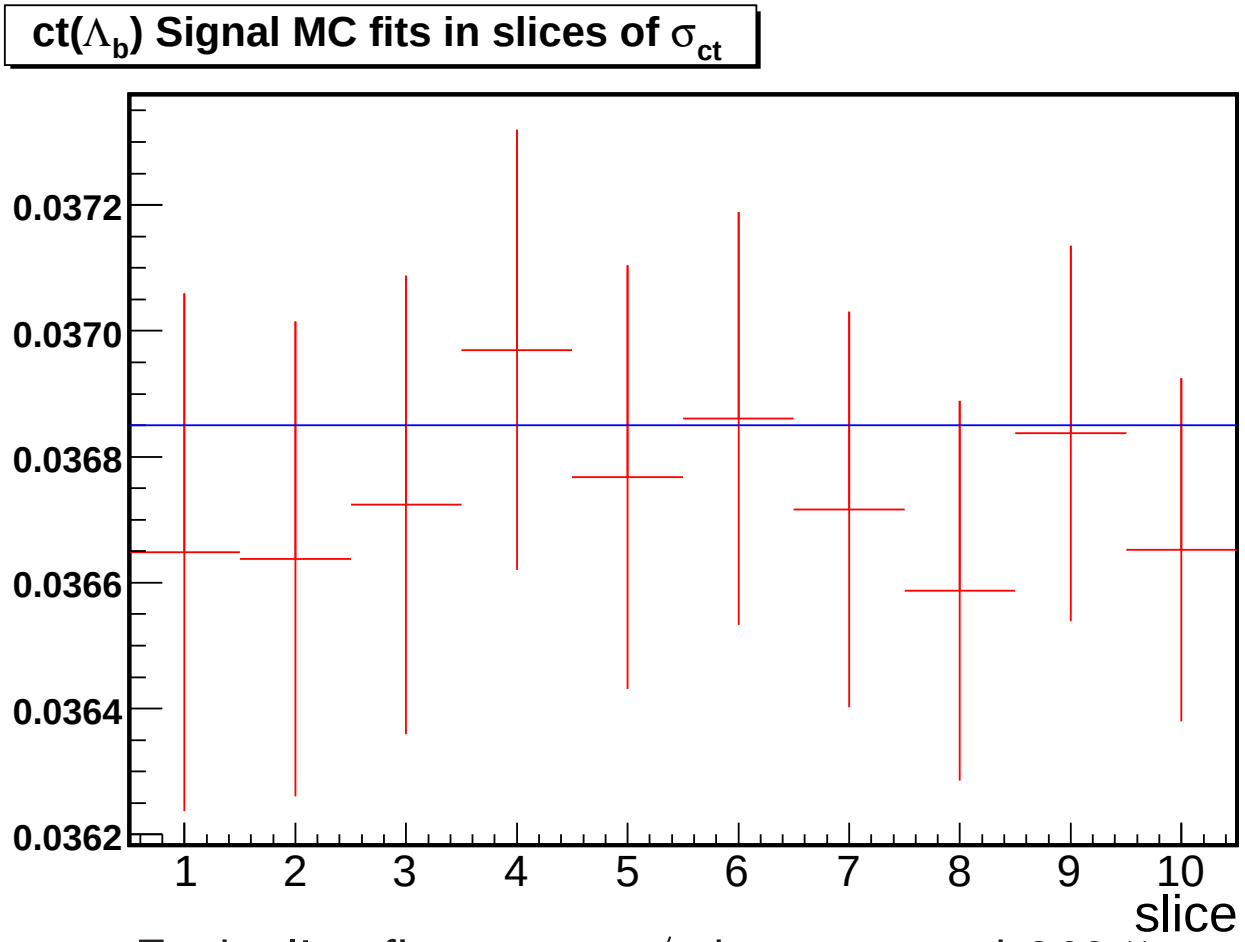
$\Rightarrow$

σ_{ct}





Fits in σ_{ct} Slices II



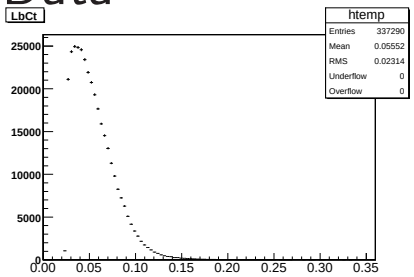
Each slice fit agrees w/ the generated $368.5\mu m$
and with the averaged efficiency result of $368.7 \pm 1.0\mu m$.

Fits in σ_{ct} Slices III

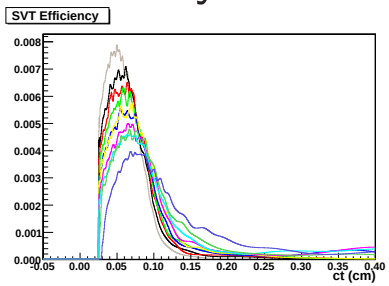
Entire MC sample is fit

Efficiency function is dynamically chosen based on σ_{ct} of event.

Data

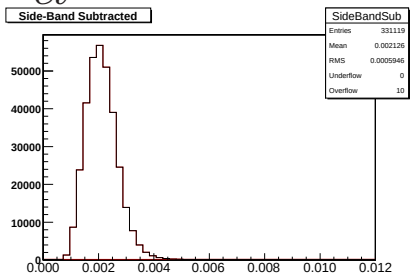


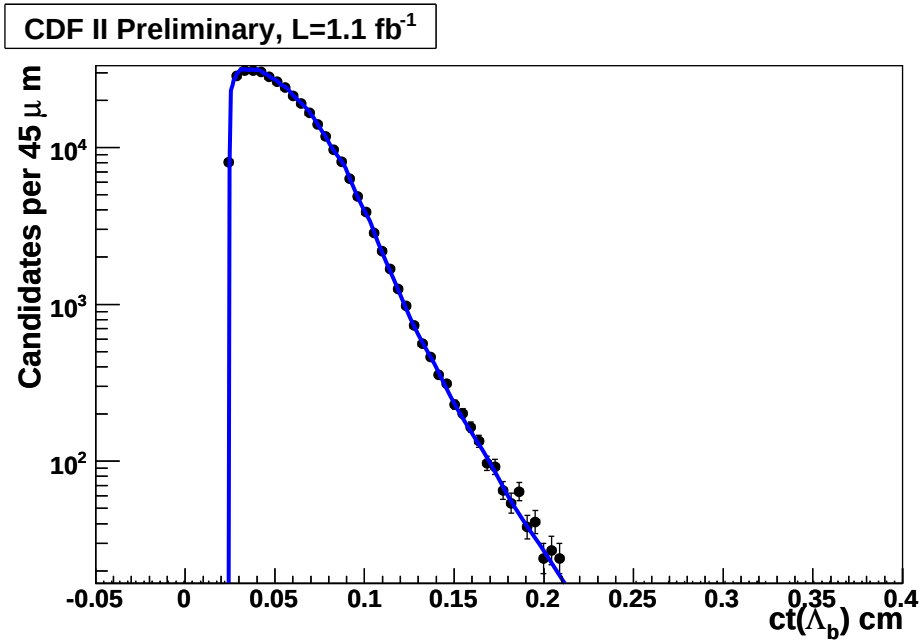
Efficiency



$\Rightarrow$

σ_{ct}

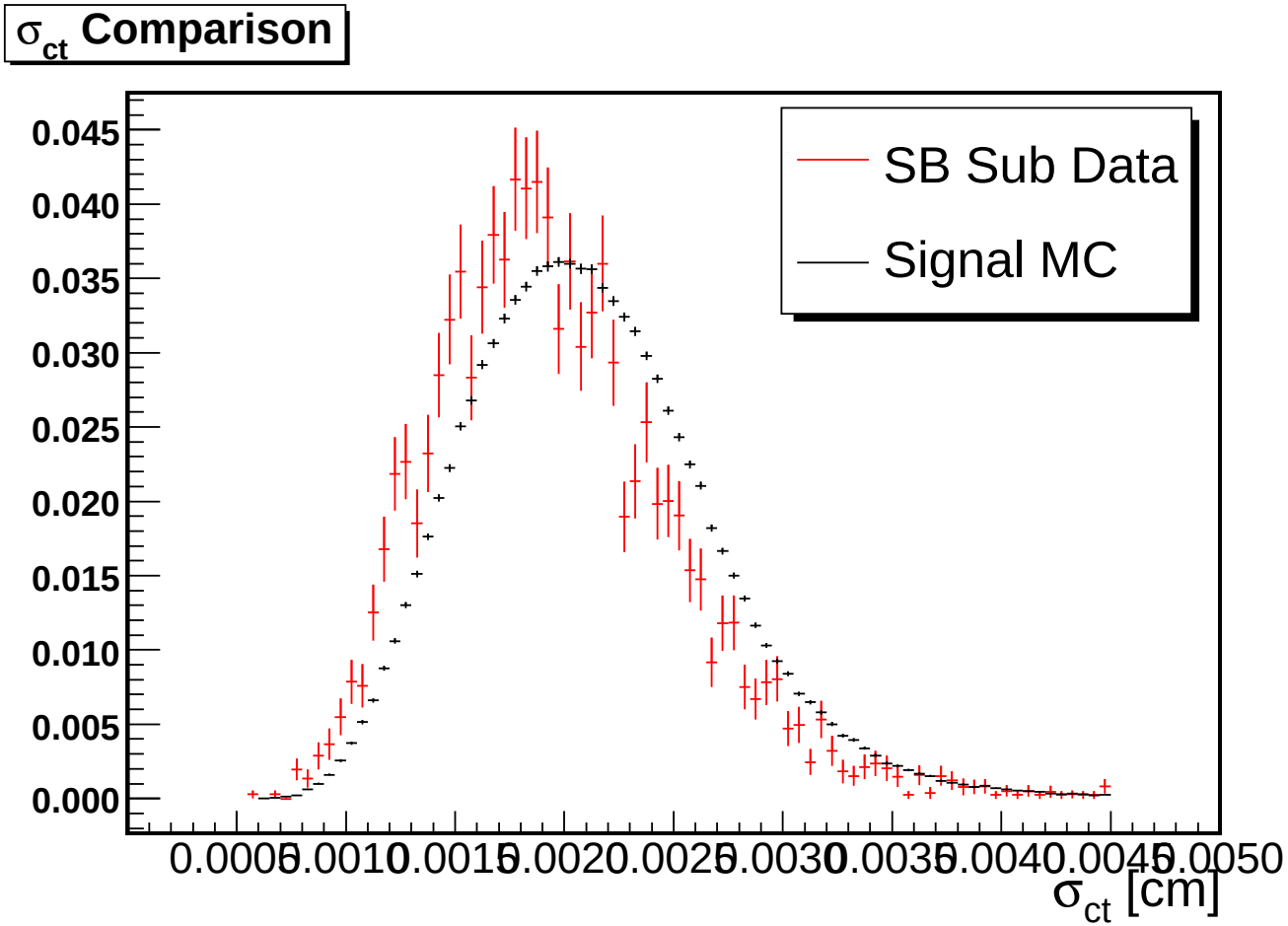




$ct(Lb) = 367.2 \pm 1.0 \mu m$

Consistent w/ Generated and Stand-Alone lifetime.

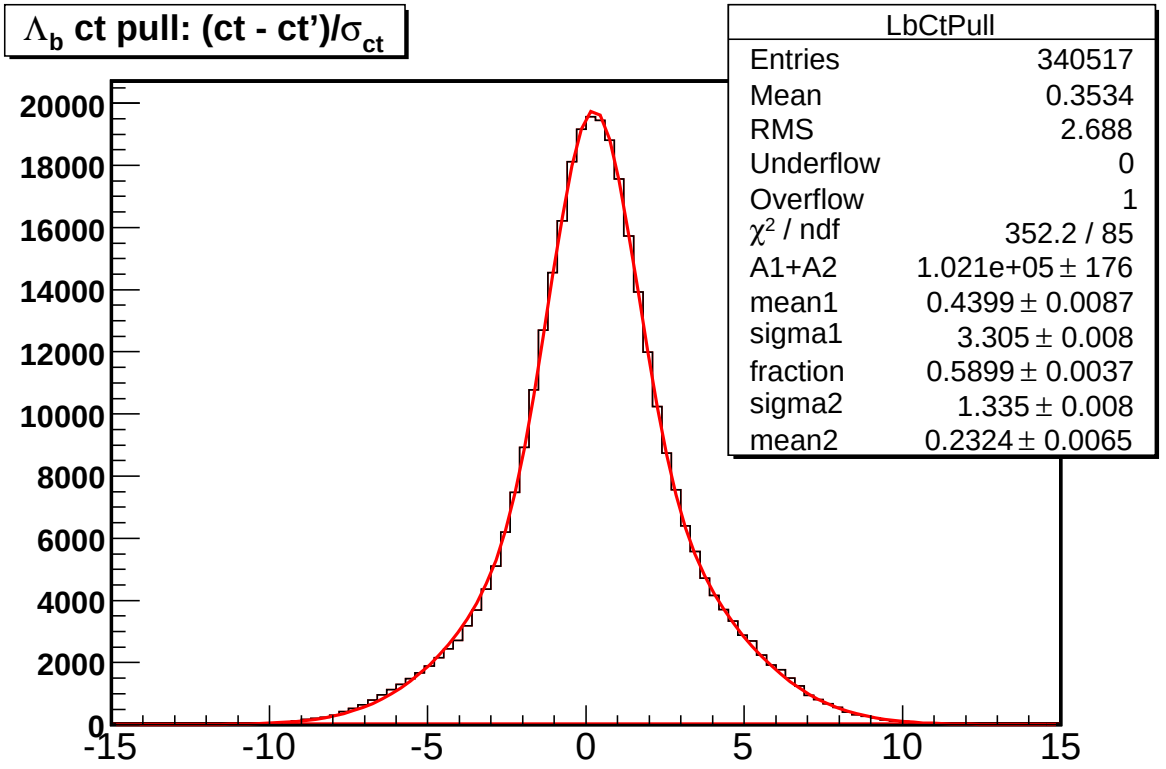
MC and Data σ_{ct} Comparison



A comparison of the RAW σ_{ct} from Data and MC.

MC Scale Factor

MC resolution is obtained from the ct pull.



Fit with a double Gaussian we obtain...

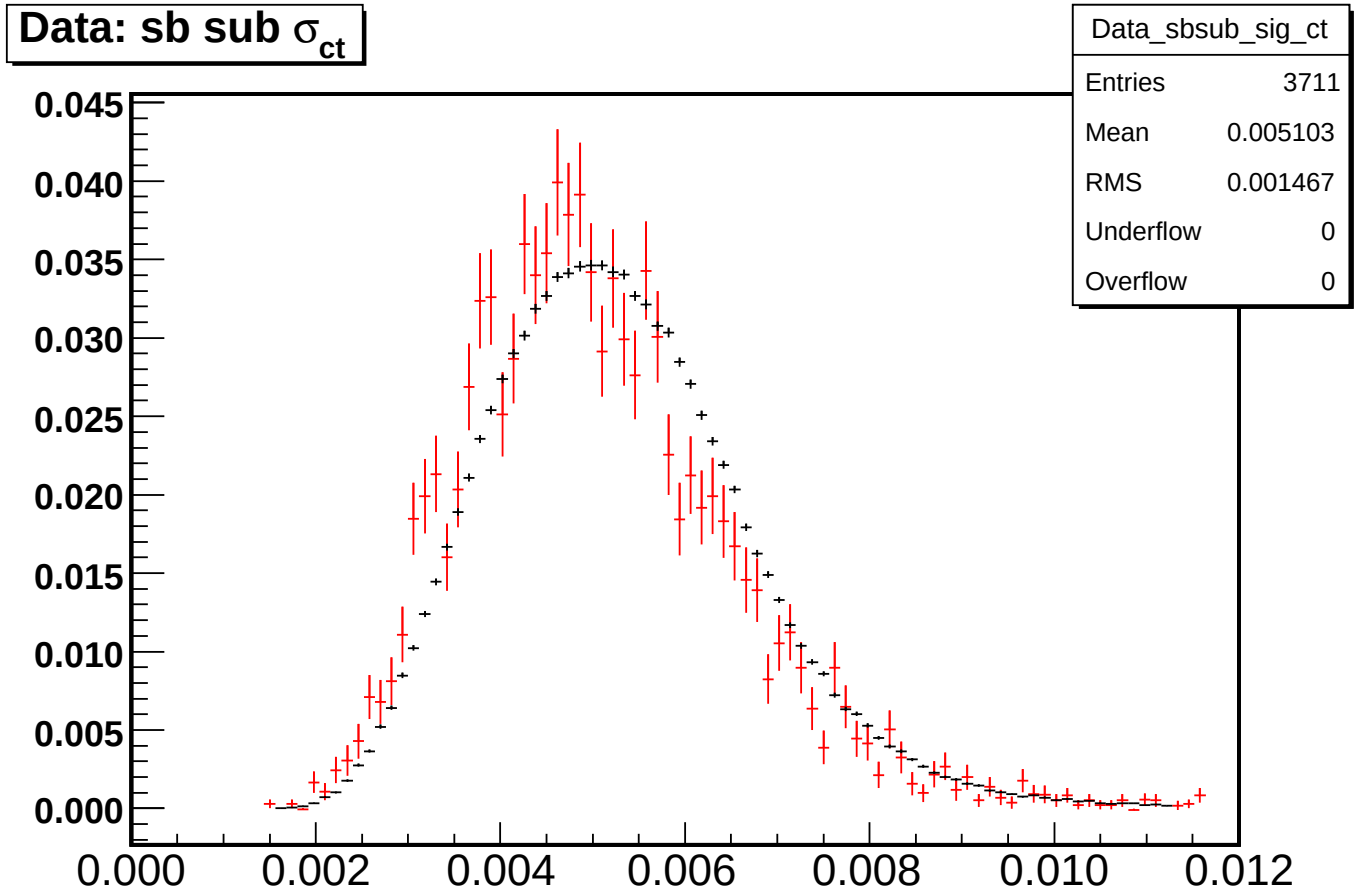
Narrow Width = 1.335

Broad Width = 3.035

Narrow Fraction = 0.41

Scaled MC and Data σ_{ct} Comparison

We *assume* the same double-Gaussian resolution in Data as seen in MC
We scale the data by 1.38 as prescribed in `cdfnote 7673`.



Choosing σ_{ct} Slices

We take the **scaled** σ_{ct} to be the true error.
The efficiency slice is chosen based on the **scaled** σ_{ct}.

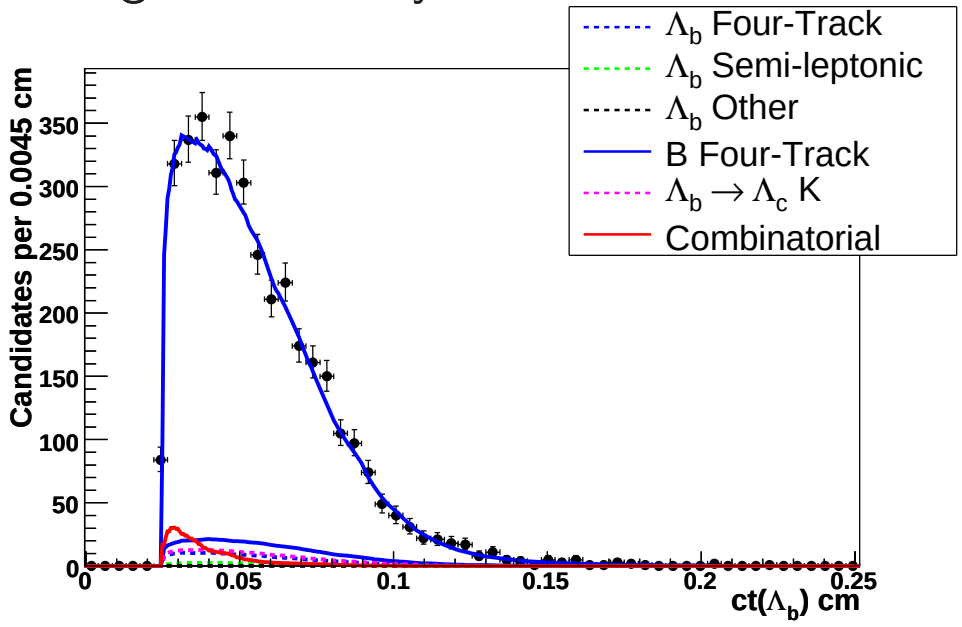
The scaled error distributions are still not the same...

This is okay though because the fit, in slices in σ_{ct}, will do the re-weighting between the two samples for us.

For Example:
If there are more events in data (compared to MC) in a given slice, those will end up with more weight (at that efficiency) in the fit.

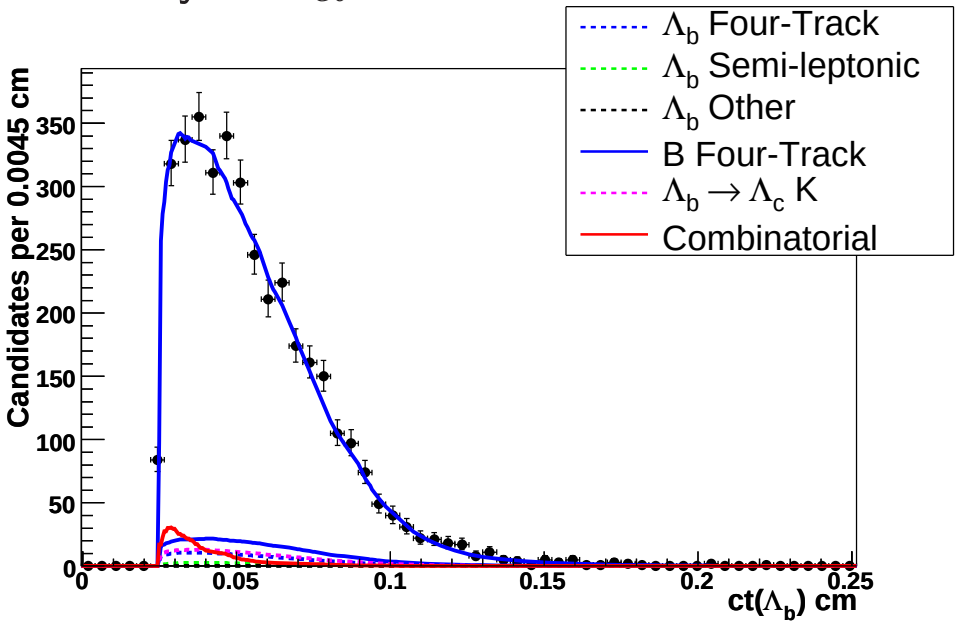
Lifetime Projection Comparison

Averaged Efficiency



$c\tau(\Lambda_b^0) = 390.1 \pm 10.5 \mu m$

Efficiency in σ_{ct} Slices



$c\tau(\Lambda_b^0) = 409.4 \pm 11.9 \mu m$

Hard to see by eye with these plots

Will have residual plots and goodness of fit numbers soon.

Conclusion

- We have finalized our fit.
- Baseline fit includes slices in σ_{ct} to account for ct,σ_{ct} correlation.
- Systematic pilot jobs are running now.
- More complicated systematics (eg mass fit, Lb polarization, etc.) are being setup.
- Expect an updated note (`cdfnote 8578`) by next week.